Fun with papers

Madhav Khare

JYOTSNA
PRAKASHAN

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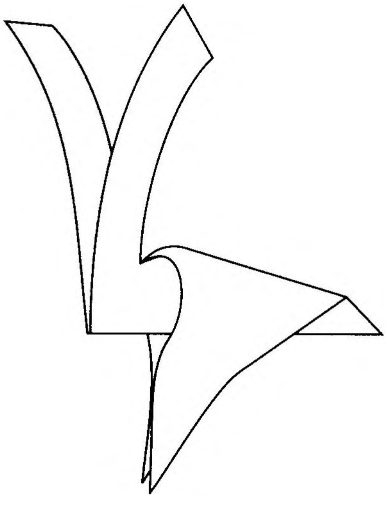

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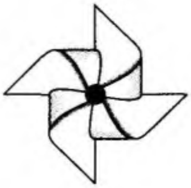
Gratefully dedicated to my school,
Nutan Marathi Vidyalaya, Pune
who had realised the importance of craftsmanship
and to my esteemed teachers
Mr. Gokhale, Mr. Tadphale, Mr. Keluskar,
Mr. Raje and Mr. Keskar, whose expertise and
craftsmanship in their subjects influenced me
and many other youngsters.



Preface

The present age is of Information Technology. Today a great source of information is available to us with a click on a mouse of a computer. One can increase one's knowledge as well as understanding using the computer. One should however be capable of deciding what to select and what to reject from this ocean of information.

Just as swimming cannot be learnt sitting in a classroom, knowledge cannot be earned by simply collecting information and solving papers. Do try to discover how many of the merit list holders managed to set their own businesses. Also try to find out as to how many of the prominent scientists, businessmen or others at high posts ever appeared in the merit lists. Then perhaps, you will perceive the difference between information and knowledge.

Doing is learning. Unless one works with one's own hands, one will never understand the intricacies of the work. Therefore, in the school curriculum, there has to be a provision for handicraft activities. In any craft, the eyes, brain, mind and thoughts are focussed entirely on the task. Such concentration is of great help in solving any type of problem. The greatest benefit of doing a thing on one's own, is the increase in the level of self-confidence. Also, it is a form of self-assessment. You do not need to pass an exam to know that you can ride a bicycle well or whether you can swim or not. You realise yourself how well you do that.

The education system today does not support any self-learning activity. Fortunately, I had had expert teachers in my school who knew the importance of self activities. I learnt a lot of things in school and also outside the school. Thus it will be helpful for people in general and students in particular, to know about several objects that can be easily done. I am confident that such activities will supplement their learning.

All articles mentioned in this book are to be made from paper. Paper is an easily available material from which literally unlimited items can be made. For several years now, I have been making many things from paper and still I always come across something new that can be made from paper!

We have planned to publish this collection of articles made from paper in a series of books. These articles are not my invention. Many of the articles have been handed down generations after generations. Nobody can state who first invented them. Some of these articles have been mentioned in the books by Dr. Arvind Gupta and Dr. Sudarshan Khanna. Dr. Khanna's book has particularly a wonderful collection of traditional toys. Also, Dr. Arvind Gupta's books are just indispensable for those who want to do creative work. Books by D. V. Kelkar, D. S. Itokar, A. D. Kokad, Ravindra Keskar and Dada Navathe are also very much useful.

I hope that this book 'Fun with Papers' which is a collection (and a little innovation) of quite simple articles of paper would engage the children as well as parents. It will also provide an opportunity to discover that handicrafts are a great entertainment and a positive pleasure. I think that it will also provide relaxation in the fast-track lifestyle of today.

Madhav Khare

Fun with Papers

Everybody likes entertainment. In fact it is as essential as a tonic. T.V. is considered to be the main source of entertainment today. But the way this form of entertainment has become stereotype and cheap, I wonder how much entertainment it really provides. People habitually keep sitting in front of it, thinking there is no replacement for it.

Handicrafts provide excellent entertainment. It is, of course, not a lazy entertainment like watching T.V. But once you get a feel of it, it takes you into an unending world of entertainment and knowledge. So vast that you start regretting why you wasted so much of your time in front of T.V.

Papercraft is not just interesting, it can relieve us of monotony. One can practise it at one's convenience, without requiring too much material, and without incurring too much cost.

We get to know paper at a very early age in our life. Babies like to tear paper and hear the sound of paper being squeezed. As students; we use paper to write on, to read from, to play with, and for various other purposes. Newspapers, magazines, books and notebooks, visiting cards, invitation cards, greeting cards, packing paper, paper dishes, paper napkins... literally an endless list.

Paper is a widely available commodity. It is available even in a small village. Thus paper is an ideal material to begin with.

How paper is made?

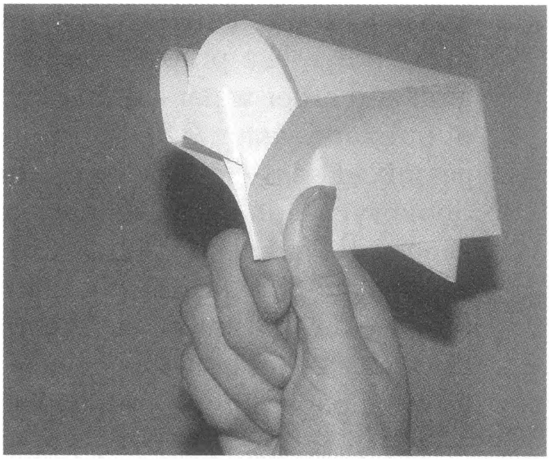
Knowing what is paper and how it is made helps to choose correct paper.

Paper is basically made from natural fibre. Plants, tree trunks, grass, bamboo, etc are sources of natural fibre. These are placed in a machine called Beater where they are pounded with force to make pulp. The pulp is washed several times to remove resin, gum and other water soluble impurities. The mixture consisting of pulp and water is flown through channels. Fibres in the pulp get mixed criss-cross as the mixture passes through the channels. Some synthetic gum is added in the last stage, so that the fibre keeps adhered. The mixture is then poured onto the broad belts made from porous and stiff cloth. The water drains out and the moist layer of fibre is retained on the belt. The belt then passes through a series of warm rollers. The moist layer of fibre dries up forming paper. In the end, paper is rolled into huge rolls.

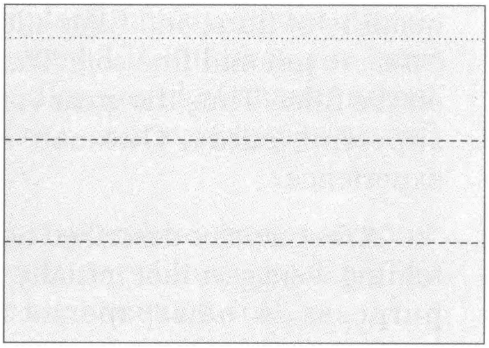
Various properties of paper such as thickness, softness, smoothness depend on three factors: Type of raw material, quantity of fibre, and filler added to it. The filler, in most of the cases, is soft and fine soil. The texture of paper depends mostly on the filler. Thus the great variety of paper – from newsprint to superfine cards. One can select proper paper only with experience.

A few articles described below can be made by simple paper folding. I suggest that initially you use a newspaper, for practice purposes. A newspaper is not only easy to fold but also inexpensive. Later, as you become confident, you may go in for the proper variety of paper.

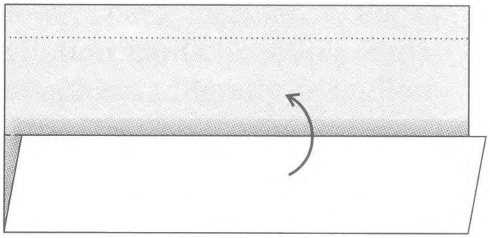
Cracker (Banger)



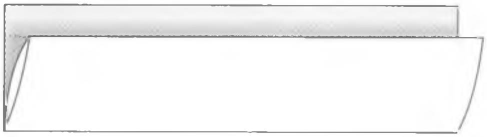
While bangers pollute the atmosphere, this paper cracker would certainly not. And what is more, the same cracker can be used over and over.



Take an A4 size (the one used in a xerox machine) paper. Place it flat on the table. Visualize a straight line running parallel to the top of the paper at a distance of about 2.5 cm. as shown. Assume further two more parallel lines which divide the remaining portion of the paper into three equal strips. If you find it difficult to visualize, measure and mark the lines on the paper.

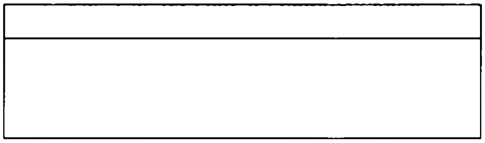


1. Fold along the lowest line as shown. This is the first fold.

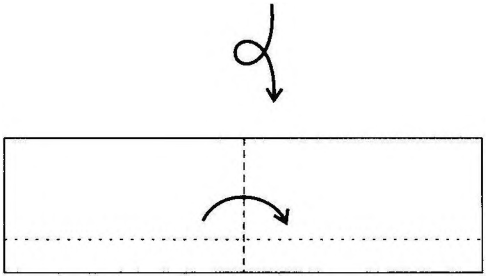


2. Make a second fold along the second dotted line.

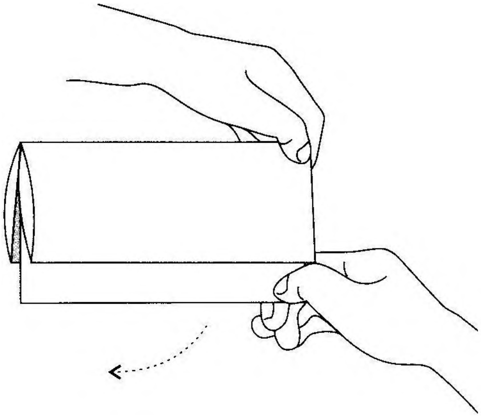
3. Folding at two places leaves the paper strip of about 2.5 cm. at the top.

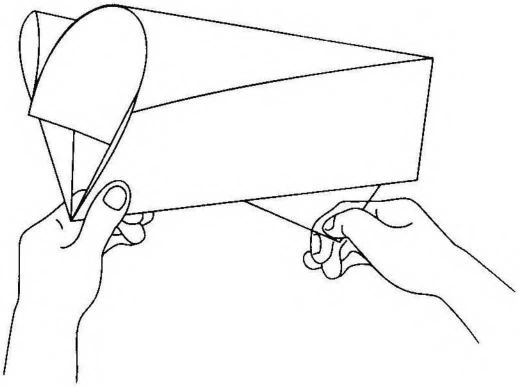


4. Flip over the paper and fold it in the centre. Ensure that all folds are perfectly pressed in place.



5. Now pull forward the lower edge of the paper strip (see figure). It will produce two conical shaped parts at the front portion.





Now hold the front tips of the paper as shown, flick the paper downwards forcefully with a jerk. The air blows open the two conical shaped parts and as the paper opens, it produces a surprisingly large sound like a cracker.

The loudness depends on the stiffness of the paper. With good quality paper you can scare someone who is unaware. You can reuse the cracker by folding the paper again.

The paper will tear on the folds or at the tips after the cracker is used for about fifteen to twenty times.

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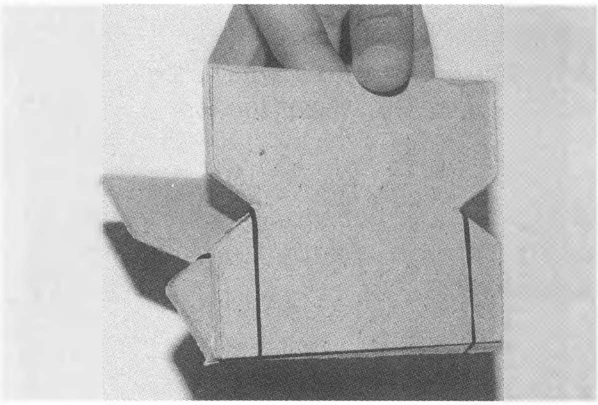
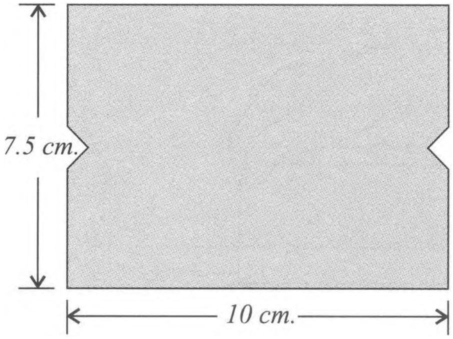


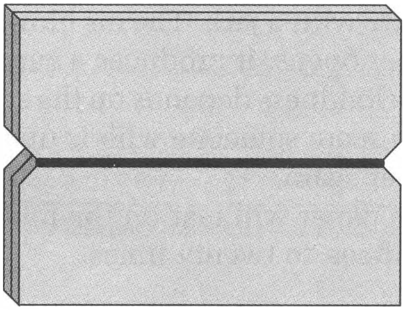
Cardboard Cracker

A cracker can also be made from thick cardboard.

If you cannot procure a really thick cardboard, paste three to four thin cardboards of old bound notebooks. Keep them under pressure. Notebook covers are generally made of thin cardboard. You will now get a thick cardboard after the pasted covers dry.

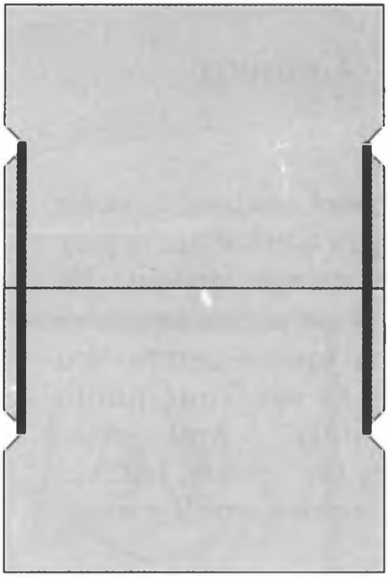


Cut two pieces of size 7.5 cm. x 10 cm. Cut two deep notches at the centre on the shorter side, as shown.

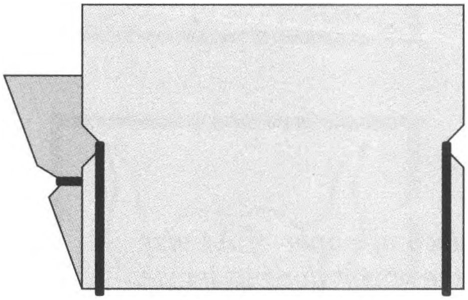


Fix a rubber band over the notches by keeping both pieces together. The rubber band should neither be loose nor tight.

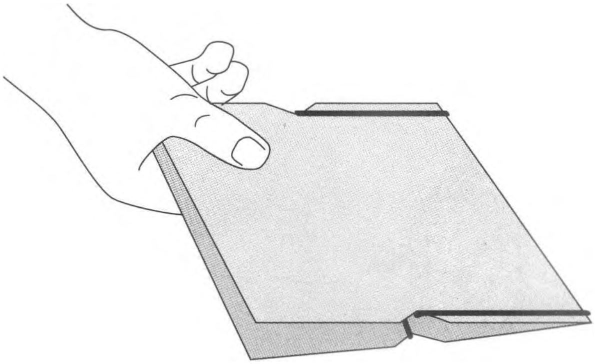
Open the pair of boards as you would open a book. Flip on and fold completely.



Hold this cracker with its open sides in the hand and toss it high in the air. The rubber band will pull both the pieces together with great force making the sound of a cracker.



The sound will also depend on the tension of the rubber. Try using different rubber bands to get the best possible sound. If the panels of thin plywood are used instead of cardboard, you can get a much louder sound. You can get the plywood pieces cut from a jigsaw machine operator in your town.



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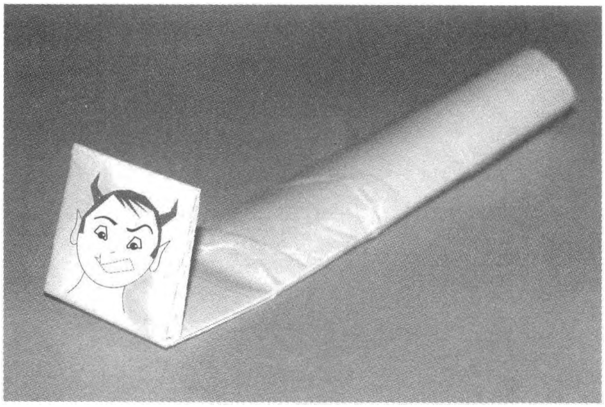
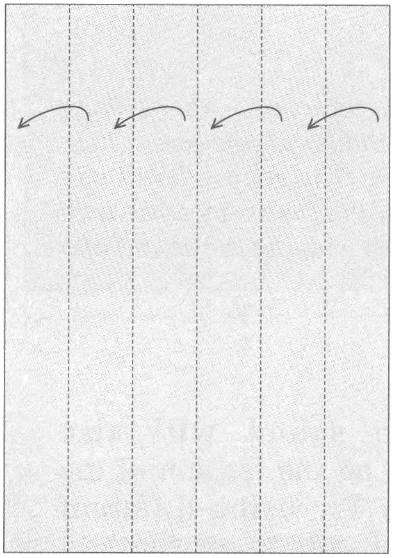
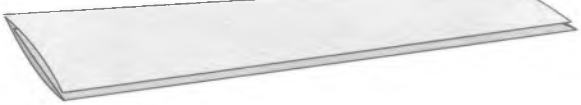
Camera



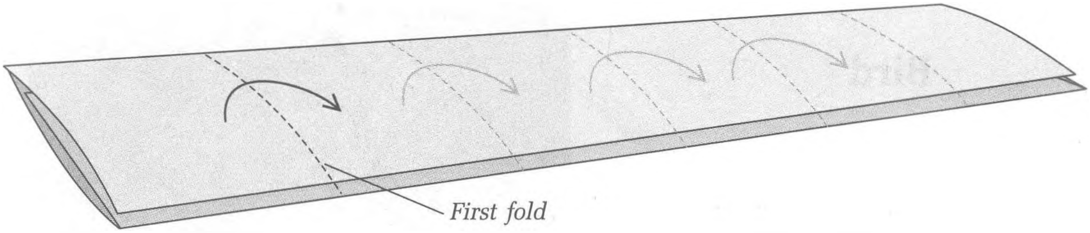
In the school, we used to make this camera quite often, to play prank on younger students. He would give a pose when told, "This is an instant camera. You will get to see your photo immediately." And after operating the camera, his face used to become worth seeing!



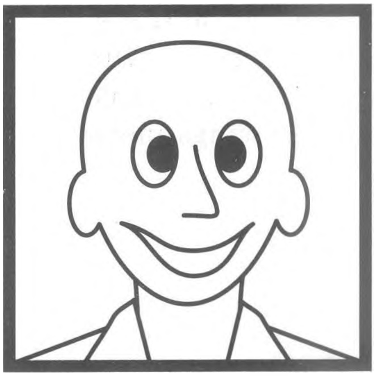
Take a piece of paper of A4 size and fold the paper along its length at an interval of 3 to 4 cm.



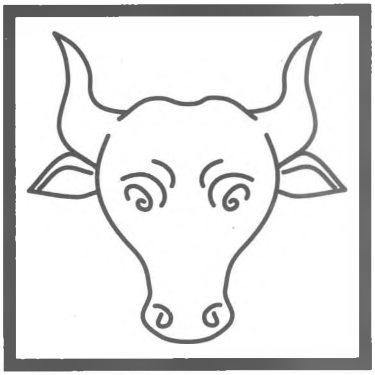
Make it into a flat long tube. Press all these folds firm.



This flat tube has to be rolled again. Make the first fold at an interval almost equal to its width. Press this fold firmly.



On the flat rectangle, draw a comic figure such as a squint joker or an angry bull. Fold this portion onto the tube. Continue to fold this tube as shown but do not make further folds very firm.



Now hold lightly the folded bunch in your fingers and place your mouth to the other side of the tube. Ask your friend to give a good pose and then blow air into the tube forcefully and as you blow, release the bunch. The paper tube will inflate and become straight with the comic figure standing in front of your friend, showing him his 'photograph'!

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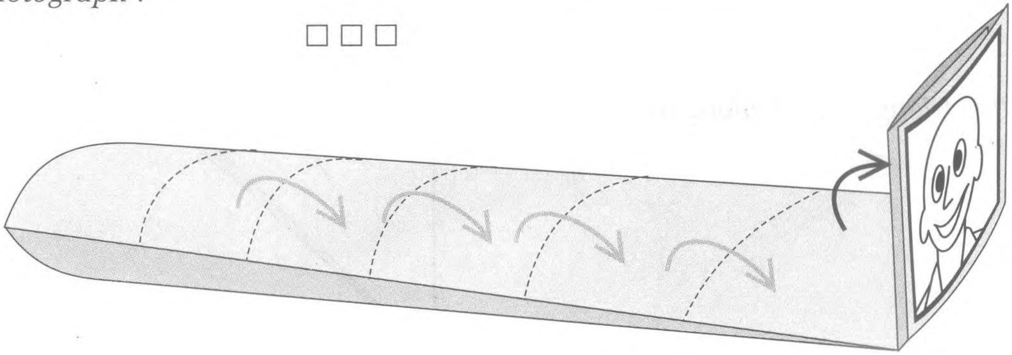
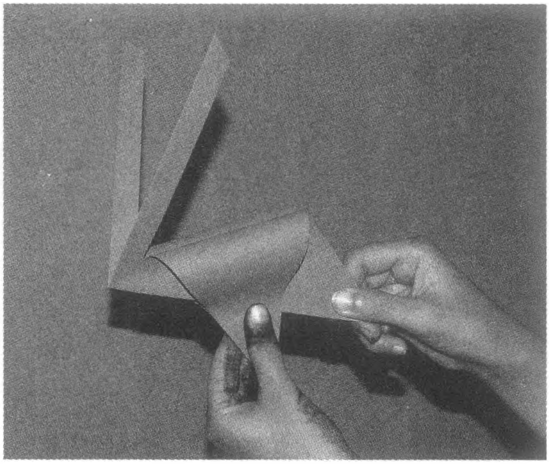
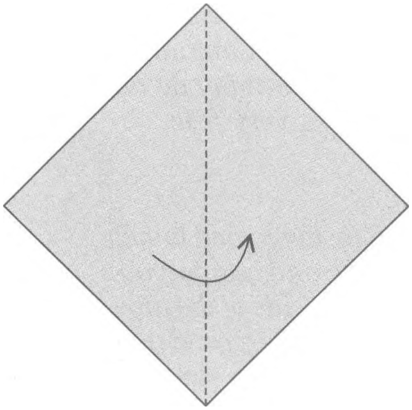


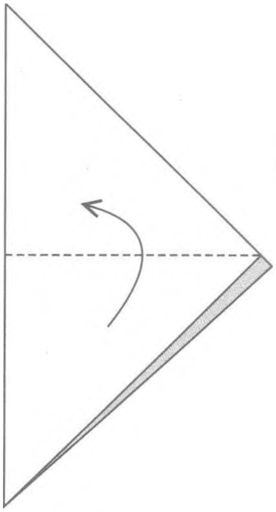
Bird



The spring action generated in paper due to rolling it, can be used to create several interesting actions. This bird functions on the same principle. It is very simple to make and the wings move realistically.

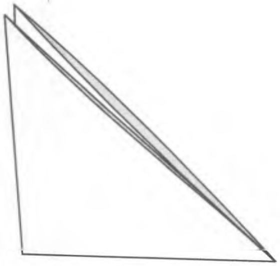


Take a square piece of paper of size 15 cm. and fold it along the diagonal.

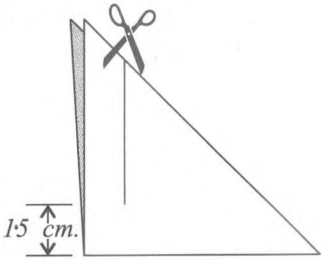


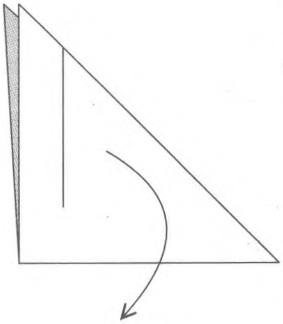
Fold this triangle again along the median.

Hold this triangle such that its open sides are vertical and closed side parallel to the ground.

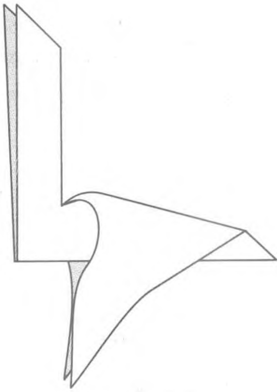


Cut the vertical sides from top as shown, leaving about 1.5 cm. distance from the bottom edge.





Roll down the triangular pieces. Hold them below the horizontal edge, as close to the fold as possible. As you push the tail of the bird forward, the 'wings' open. Pull it back and wings close.



Once you know the technique, you can cut wings similar to those of real birds and then enjoy seeing movements of the wings.

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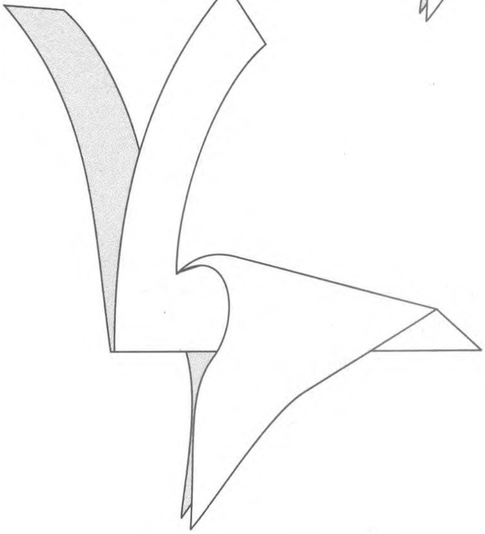
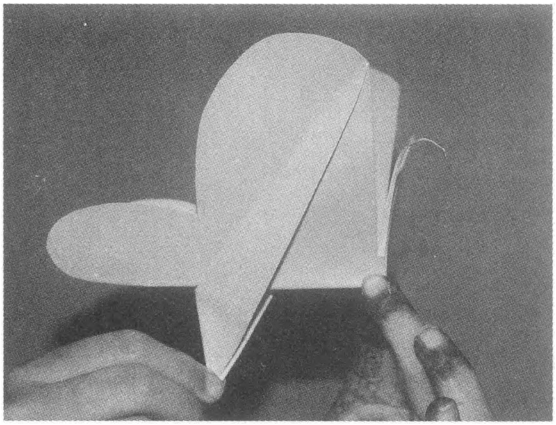


Butterfly

The technique of making this butterfly is similar to that of making a bird with slight modification.



Fold a square piece of paper of size 12 cm. on its diagonal, and reopen (fig. 1). Fold it again along the dotted line as shown (fig. 2). There will be a smaller triangle on the larger triangle.

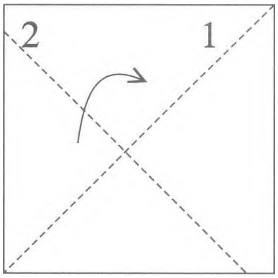


Figure 1

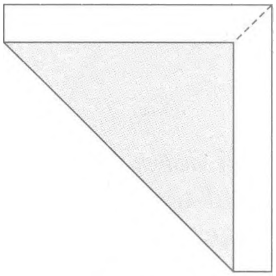


Figure 2

The smaller triangle has two more dotted lines. Fold the paper along each and reopen (fig. 3-4-5).

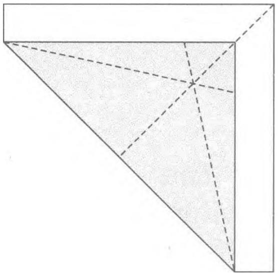


Figure 3

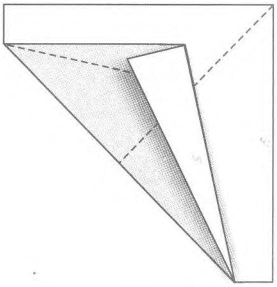


Figure 4

When both the portions are folded simultaneously, the common central portion will stand up, as shown in fig. 6.

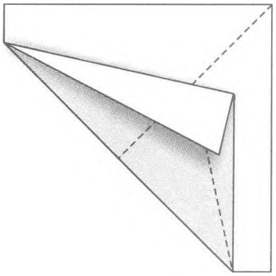


Figure 5

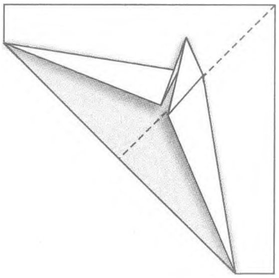


Figure 6

Fold the paper at the centre such that the common portion protrudes down as a tooth, as in fig. 7.

Now draw the shape of a wing of a butterfly as indicated in fig. 7. Cut away the outer portion (shown lined). Take a sleek cut, as shown in the figure, on the front side.

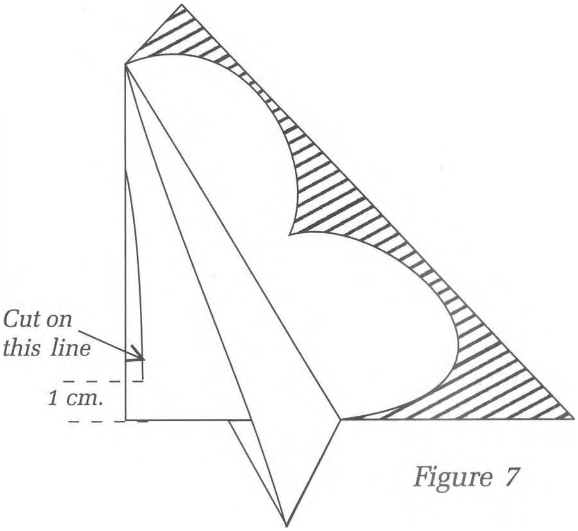


Figure 7

The butterfly is ready for action as shown in fig. 8. Curl frontal paper to form tentacles.

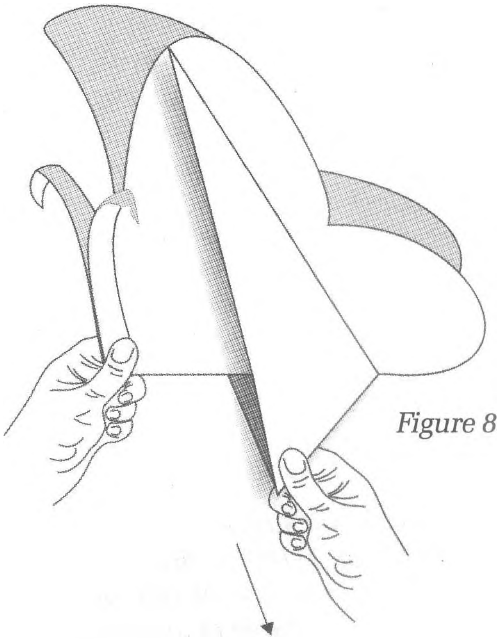


Figure 8

Now hold this butterfly at the front. With other hand pull the tip of lower triangle down and the wings of the butterfly would open. Release it, and wings go up again. This wing movement looks very much real. You can paint the wings in realistic colours to make it look like a real butterfly.

Now if you could make several such butterflies with different shapes proportional to the real ones and true colours, it could be a very effective project on butterflies.

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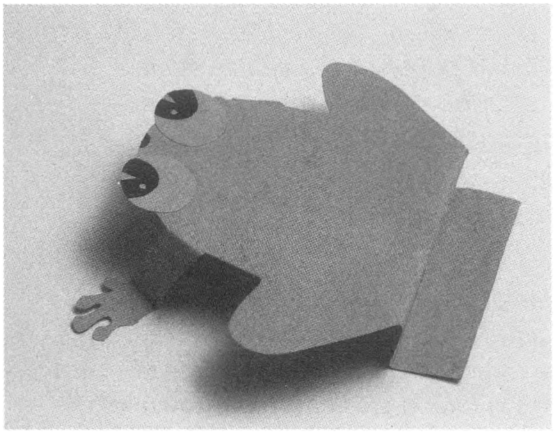
Frog

The paper frog is another toy that works on the principle of the spring-action of a folded paper. You need a thick paper like the one used for say, a toothpaste carton. This paper is known as box board or duplex board.



Cut a piece of size 7.5 cm. x 10 cm. Draw two lines along the width at a distance of about 1.2 cm. Draw a picture of a frog as shown in the upper portion. It is important to draw the left and right halves exactly equal. For better picture, first draw only a half part of the frog on another piece of paper and cut it. Use this piece as a stencil to draw the frog onto the main piece of paper.

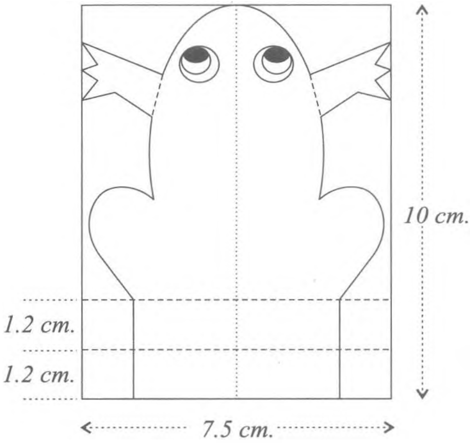


Figure 1

Fold the two lower strips of 1.2 cm. as shown in fig. 2. Due to this, the folds will get under the picture of frog. Now cut the shape of the frog including the folded paper.

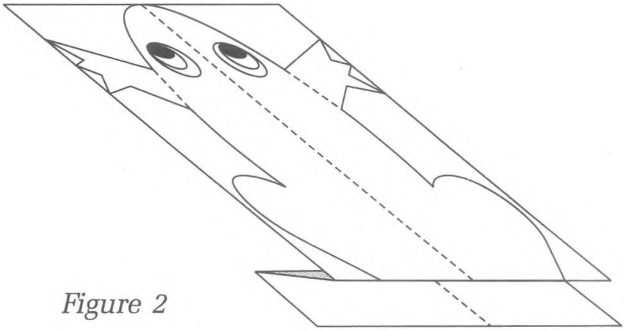


Figure 2

Bend the forelegs of the frog downwards. Curve the body of the frog slightly. The folded paper at the back looks like hind legs and the frog appears in a squatting position, as shown in fig. 3.

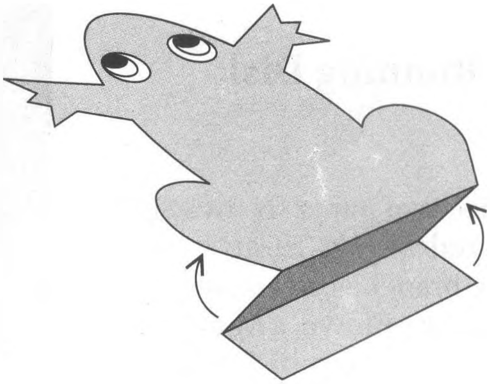


Figure 3

Now as the back edge of the frog is pressed with the tip of a finger, the frog slips. The paper reverts to its original form like a spring and as this happens, the frog is pushed ahead which appears like a leap (fig. 4).

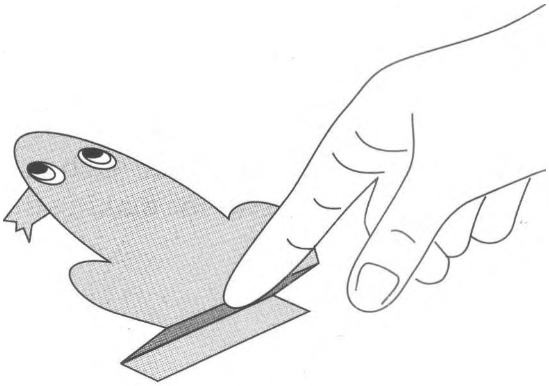


Figure 4

The technique of pressing with one's finger and making the frog jump needs practice. In school, we used to organise race of such jumping frogs. One who crossed the distance between two lines on the floor would be the winner.

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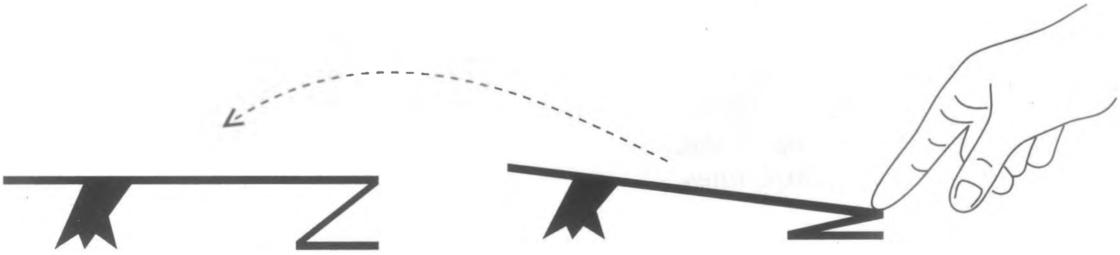
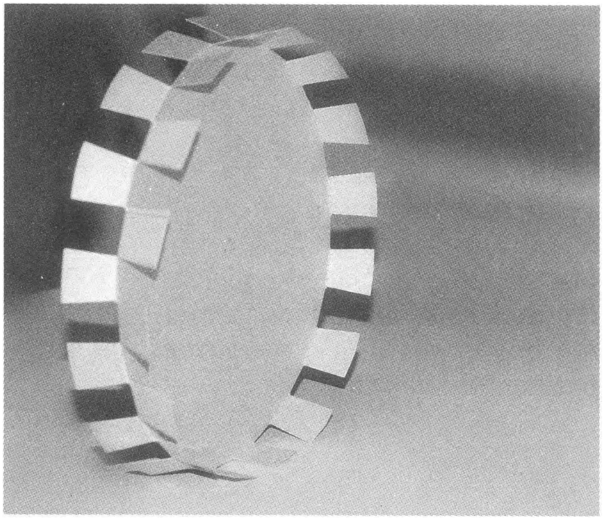


Running Disk



Pieces of paper fly away as the wind blows. Straws, dry leaves, branches, even roofs of houses are blown away by a strong wind. The disk shown here runs along the ground at a high speed. At times, the disk runs so fast that it becomes a hard job to chase and catch it! This is of course possible only on a vast open ground. Sea beach is ideal for operating this disk.

A good quality, thick paper such as the 'Executive Bond' paper used for letterheads, is quite useful for making this disk.

Take a square piece of paper of size 12 cm. Draw two concentric circles on the paper with diameters 10 cm. and 8 cm. Draw two diagonals such that they are perpendicular to each other. With the help of a protractor divide the segment into 8 parts. Similarly draw and divide other segments so that the total circle gets divided into 32 parts. Cut along these lines from the circumference up to the inner circle marked. (Dark lines shown in fig. 1.)

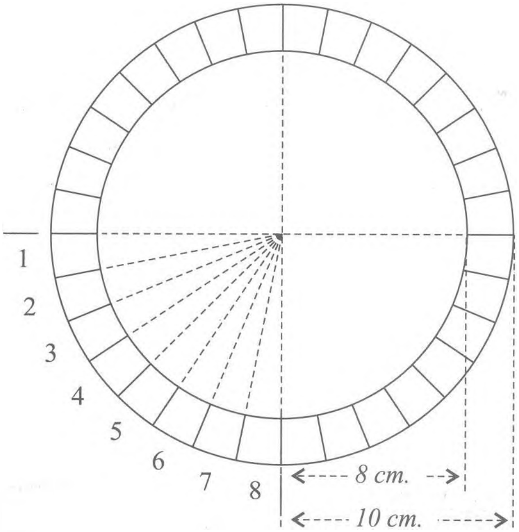


Figure 1

Now fold the alternate tabs at right angles as shown in fig. 2. The disc is now ready.

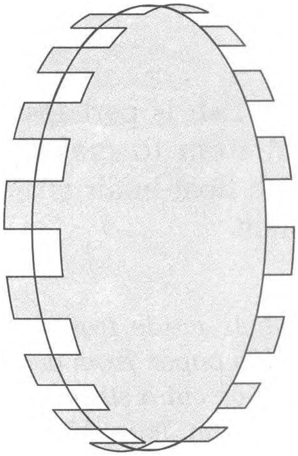


Figure 2

In the open ground, place the disk on the ground, parallel to the wind direction, and give it a little push. It will soon pick up speed.

This disk can easily pass over pebbles or sticks lying on the ground. Paint the disk in different colours to make it look attractive.

A moving disk painted with seven colours of the rainbow will prove that white colour is made up of seven colours – the principle of Newton's Disk.

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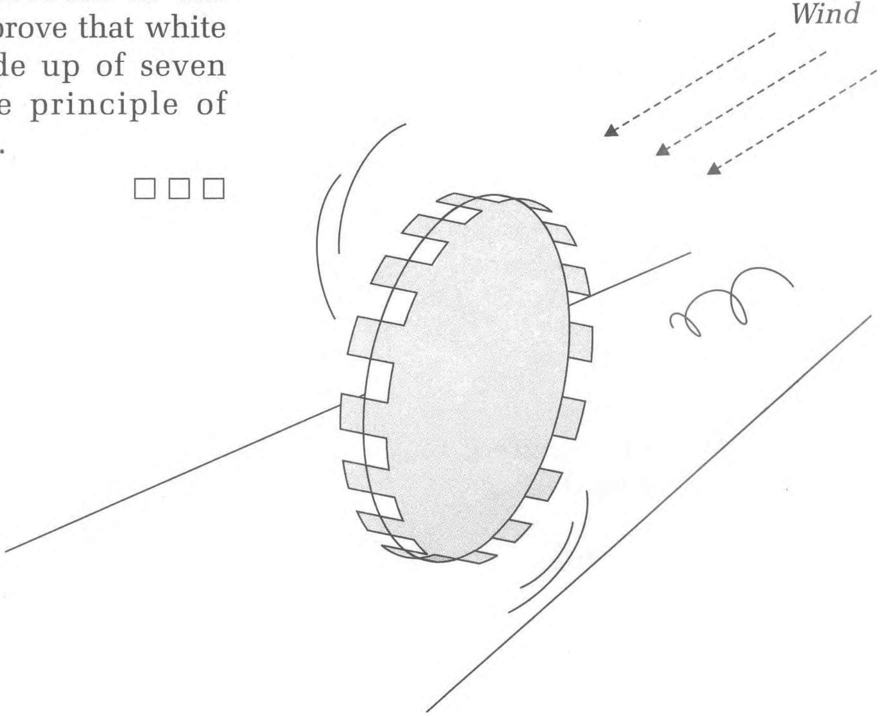
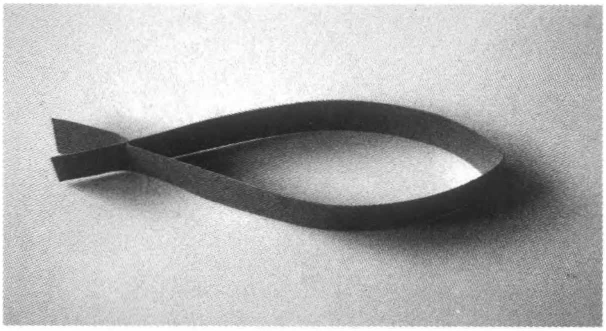


Fish



The paper fish is perhaps the simplest item to make. Seeing the fish float in air is a wonderful sight.

The paper fish is made from a single strip of thin paper. From the page of a notebook cut a strip 1.5 cm. wide and 15 cm. long. Make two slits at a distance of 2 cm. from the edges. The two slits, one at the top and the other at the bottom should extend to the centre as shown in fig. 1.

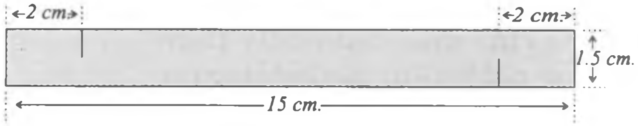


Figure 1

Now bend the strip at the centre and interlock these slits (fig. 2).

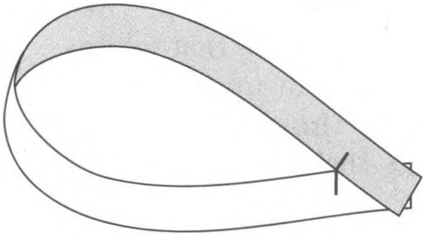


Figure 2

Press this fish gently to make it oblong, as shown in fig. 3.

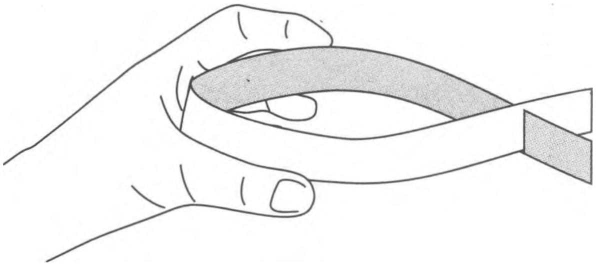
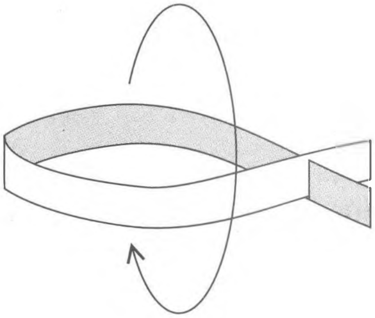


Figure 3

Release the fish in the air at some height. It starts spinning about and lands steadily on the ground. If the fish is made from a lighter but stiffer paper, its speed of descent decreases. In the moderate and rising winds, this fish floats up longer in the air or even ascends up.



You can make several such tiny fishes and release them simultaneously. The smaller fish would float for a much longer time. In a calm atmosphere, the fish traverses a helical path (fig. 4) as it descends to the ground. If its size is altered as shown in fig. 3, its speed of spinning on its axis as well as that of descend changes.

The flight of this simple looking fish is still an enigma to the aerodynamics engineers. They are yet unable to give any convincing explanation as to why the speed and the spin of the fish varies with its thickness and why does it traverse the helical path.

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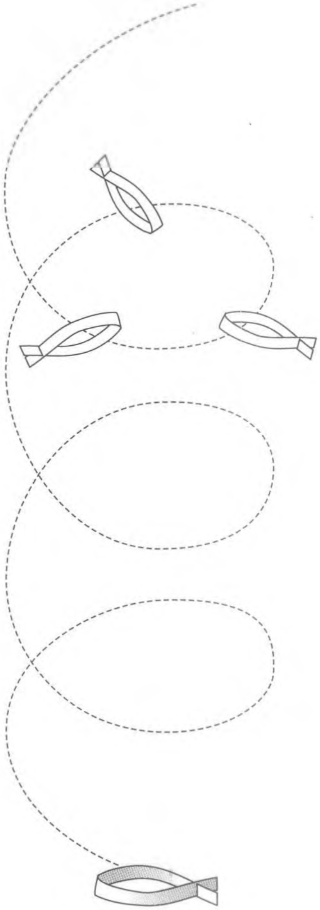
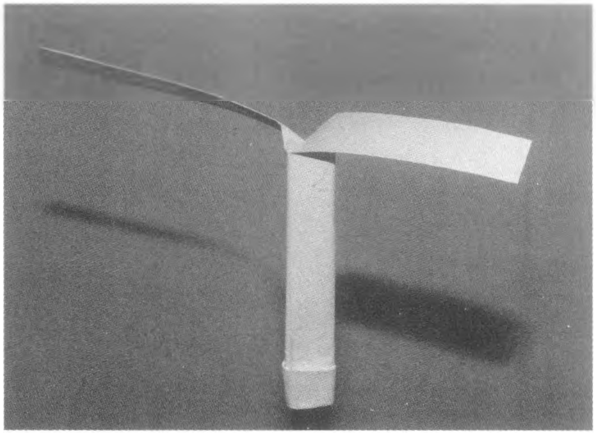


Figure 4

Helicopter 1



Let us make a paper helicopter by simply folding and cutting paper. This paper helicopter will have two blades at the top and will spin like a real one.

Select a paper that is stiff but lightweight. Cut a piece of 4 cm. x 15 cm. Draw three lines at an interval of 1 cm. to divide paper into four parts. Remove a piece of 6 cm. size as shown in fig. 1. Remaining 2 cm. of paper is to be split into two parts by cutting along centre line. Now fold the lower portion of the paper at the distance approximately .75 cm. Flip the paper and crease along the vertical lines as in fig. 2.

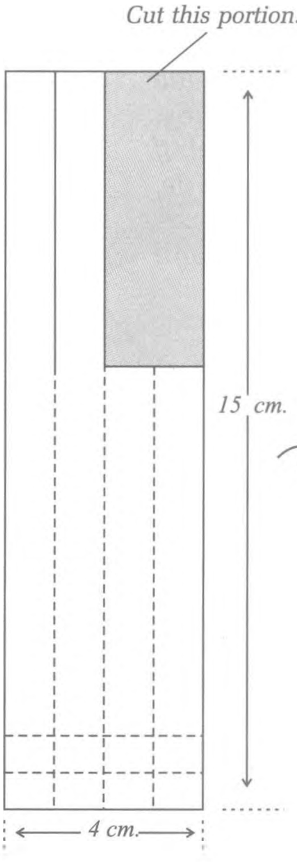


Figure 1

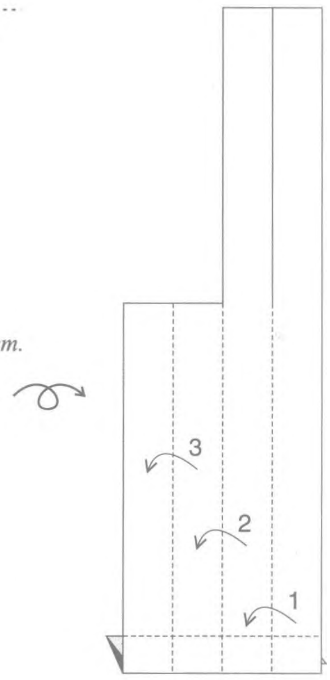


Figure 2

Finally staple the bunch at the bottom or stick the lower part with a tape (fig. 3).

Now the upper two blades are to be folded. Fold slightly at an angle the blade on your side as shown in fig. 4. Similarly, the opposite blade is to be folded at the same angle in the opposite direction (fig. 5.)

Now keep the blades parallel to the ground. The blades will be slanting and in angles as shown in fig. 6.

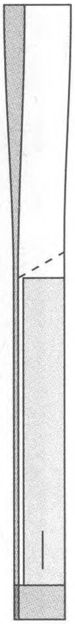


Figure 3

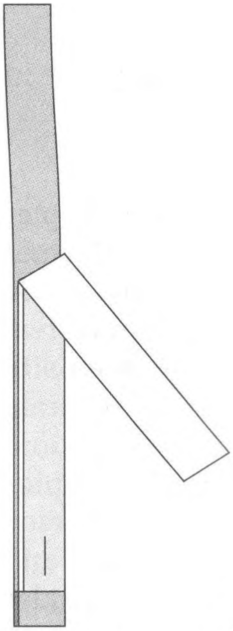


Figure 4

Launch this helicopter in the air like you launch the paper dart.

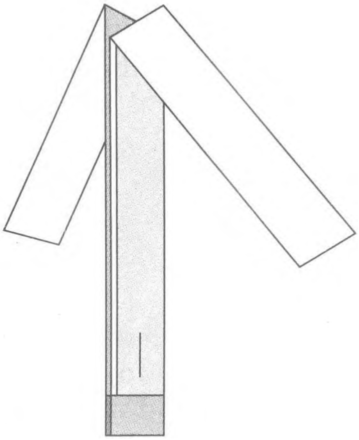


Figure 5

The helicopter gains height and then becomes straight due to the weight of the folds and the staple pin. The blades then function like propeller and it spins speedily as it descends. In stronger and rising winds, the helicopter can ascend to a significant height. If it does happen, then it is the most beautiful sight to watch! This, however, may not always happen.

* * *

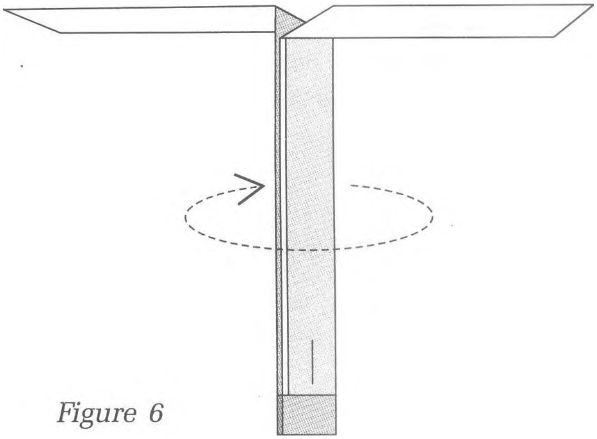
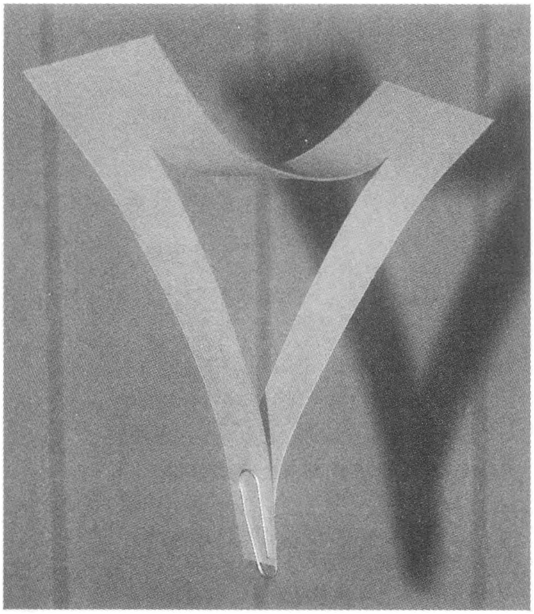


Figure 6

Helicopter 2

This design of a helicopter will show you how well paper can be shaped easily. The principle here is to have two blades inclined in opposite direction. The more accurate and balanced the inclination, the smoother the helicopter floats in the air. Such accuracy is built-in, in this design, and it is quite simple too. I consider this to be the best design.



Cut a strip of size 3 cm. x 15 cm. from writing paper of normal thickness. Draw two lines parallel along the length spaced at 1cm. from each other. Now cut along one line from top leaving the last 2 cm. Cut along the other line from bottom, leaving the last 2 cm. at top (fig. 1).

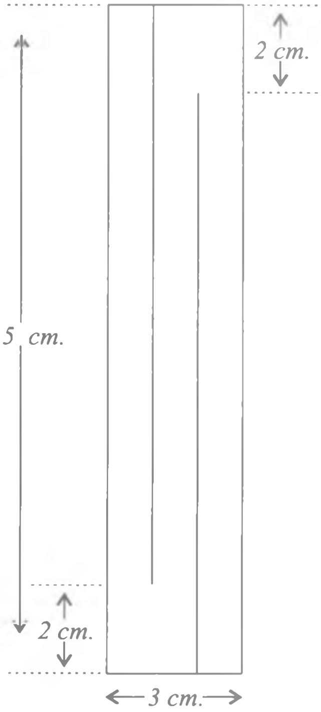


Figure 1

Now lift up the paper holding at its tips, so that two strips dangle down. Hold these two strips together and put a paper clip onto them (fig. 2). Your helicopter is ready! Before you fly it, observe it carefully. See how perfectly the tips get a slant angle. Try to visualise the geometrical symmetry in the structure. Such understanding of the subject is always joyful.

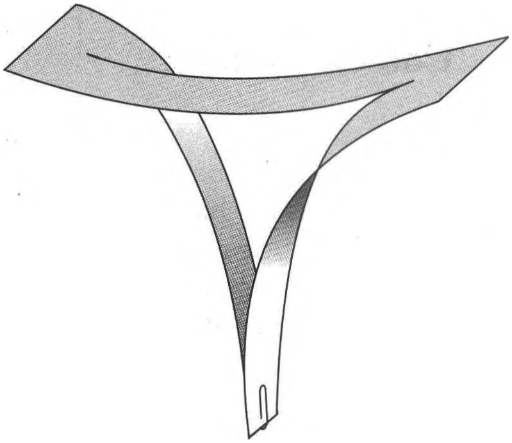


Figure 2

Now raise your hands and release the helicopter. It will descend spinning fast. When released from a greater height, it will even soar up with stronger wind. You have ample scope to experiment with it, by changing the size of paper and by using different grades of paper. Note that you may need to alter the weight attached at the bottom, depending on the shape, size and weight.

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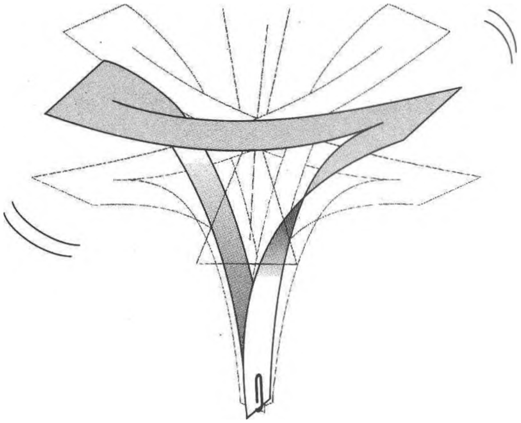
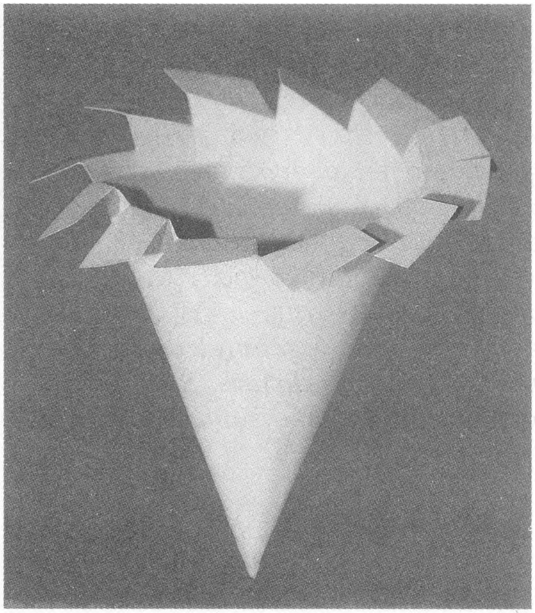


Conical Rotor

You must have seen the paper cones used by hawkers selling popcorn, peanuts and grams. A rotor here is made by using similar structure. Of course, you have to construct it meticulously making a drawing on paper.



On a sheet of paper, mark an obtuse angle of 120⁰. Draw three arcs at the distance of 8.5 cm., 9 cm. and 10 cm. from the centre.

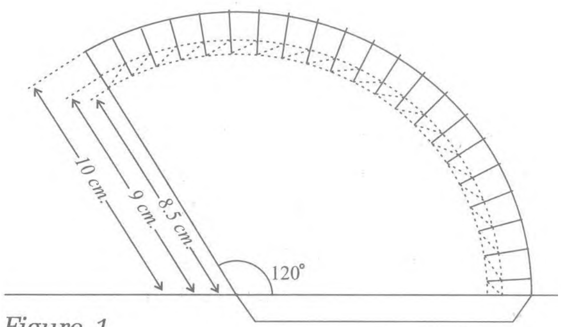


Figure 1

Draw a flap on one side. Cut this piece of paper and roll it carefully into a neat cone ensuring that the tip of the cone is formed perfectly (fig. 2).

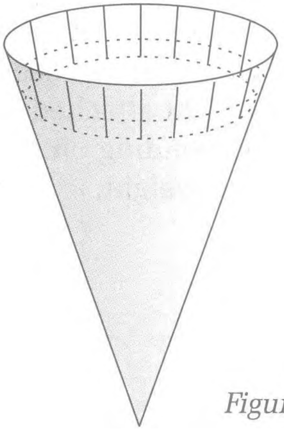


Figure 2

Make the cuts of width 1 cm. reaching the lowest line, all along the circumference. Now fold these cuts at an angle as shown in fig. 3. It will result in a set of small blades entirely along the edge of the cone, as shown in fig. 4.

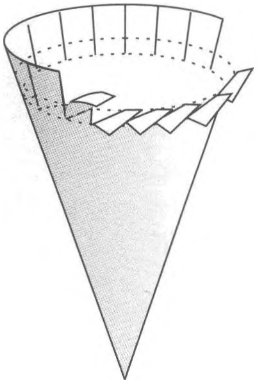


Figure 3

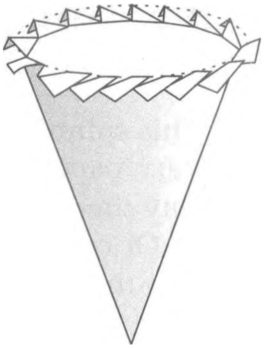


Figure 4

Place this cone on a pointed stick, a ballpen refill or a sharpened pencil. Keep the cone horizontal as you start running (fig. 5). The rotor starts to spin at a high speed. If you paint designs on the cone, it looks more beautiful.

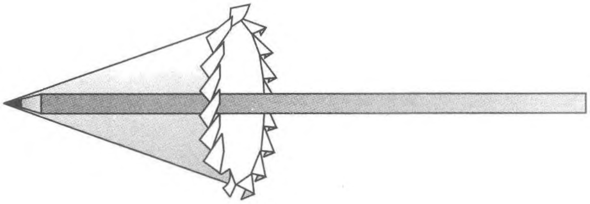


Figure 5

Also note that the shape of this rotor is typical. It looks exactly like compressor or turbine blades of a jet engine. If you manage to place this in a paper tube properly, it would look like a jet engine.

This rotor can also be released from a height. However, in such a case you need to fix a small pebble in the tip of cone to keep the rotor vertical. In this manner, it descends down spinning fast and drifting along the wind. It is an unusual type of spinning toy.

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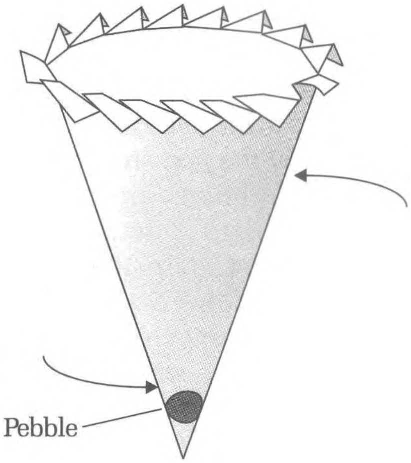
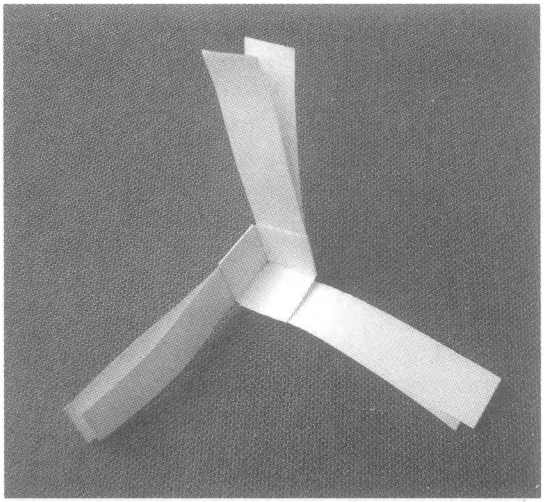


Paper Strip Spinner



This spinner is made from ordinary paper. You could do this any time with any type of paper. Of course, you need to practice the technique well.

Cut three paper strips of the size about 15 to 20 cm. long and 1 to 1.5 cm. broad (fig. 1).

Fold them at the centre (fig. 2). The strips are numbered 1, 2, 3 for the purpose of explanation.

Now hold strip 1 horizontal with its folded side to the left. Place strip 2 in the fold of the first strip, with its closed side above and open ends below. Strip 3 is placed around the first strip with its folded side below. Study the arrangement shown in fig. 3, because holding the strips in this manner is the key in making of this spinner successfully.

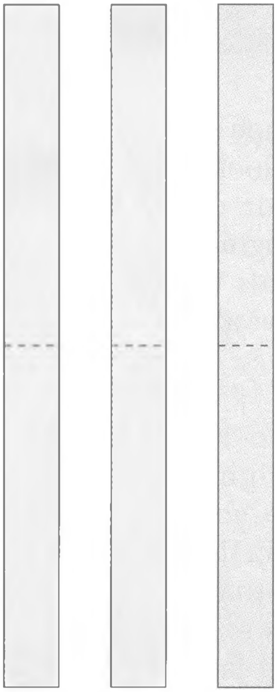


Figure 1

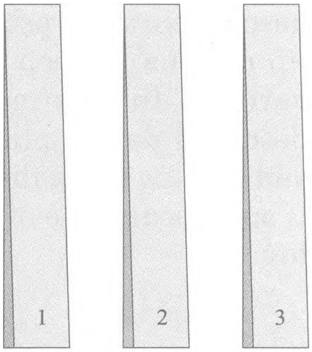


Figure 2

Now both the tips of strip 3 should be pushed through the upper part of strip 2 as shown in fig. 4. Then pull the ends turn by turn till the folded edges of the strips stand at right angle like the corner of a box (fig. 5). The spinner is ready.

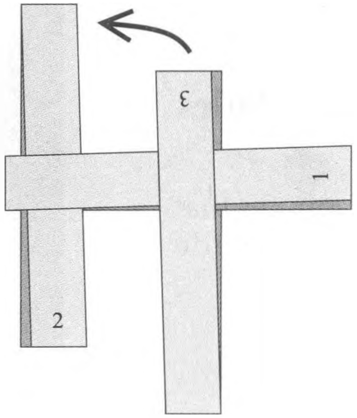
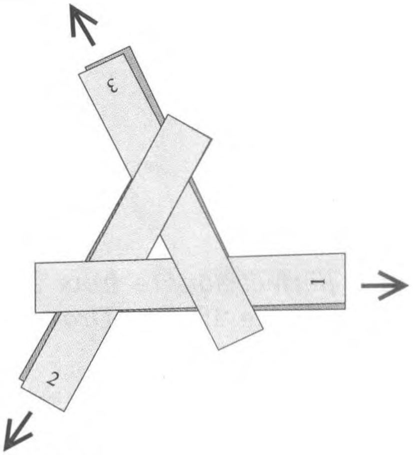


Figure 3

Place it onto a pointed stick and start running. The spinner spins elegantly.

Figure 4



You may also release it from height and enjoy its free spinning. This spinner does not need any specific type of paper, and can be made easily and given to the young children, as an assured entertainment.

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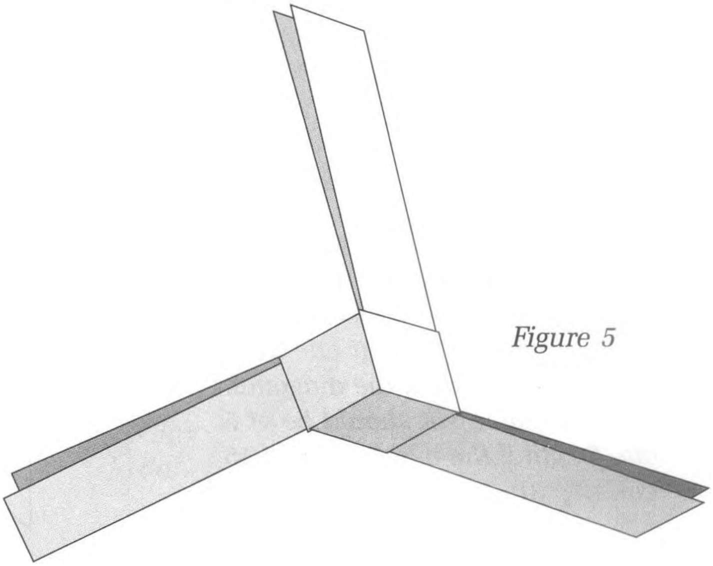
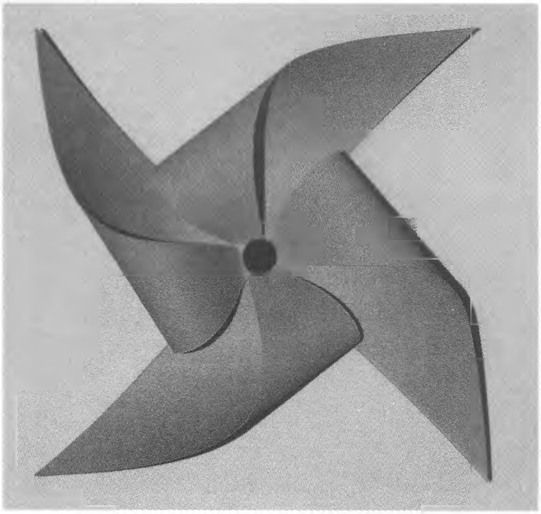


Figure 5

Spinner with four blades

It is the same spinner that you can buy at a roadside hawker.



Cut a perfect square from stiff paper of size 15 cm. Draw its diagonals (fig. 1).

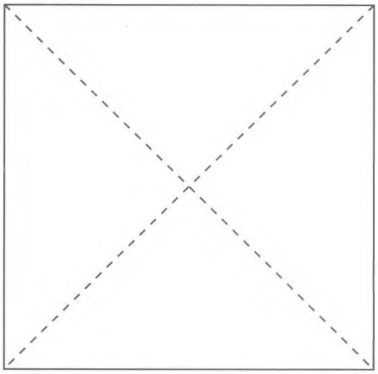


Figure 1

Now you need to cut along the diagonals partially. Make the slits from each corner, about one third of the total length of the diagonal. For example, a slit should be of 5 cm. length if the diagonal is of 15 cm. (fig. 2).

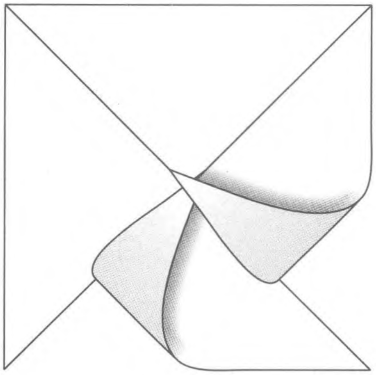


Figure 2

Pierce a long and sharp pin through a few tiny pieces of paper. Bring them next to the head of the pin. Now lift one of the corners and pierce the pin through it. Lift the next corner on the right and push the pin through it. Repeat the same exercise in sequence for the remaining two corners. The spinner will finally look like the one in figure 3.

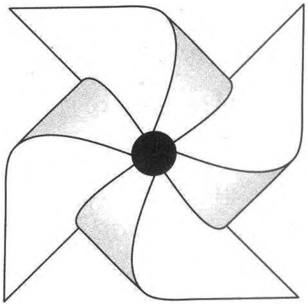


Figure 3 (Front-view)

Finally pierce the pin through the centre of the square as shown in figure 4. Now slide a bead over the pin and push the pin into a soft broom stick, such that the spinner does not get tightly pressed or remain too loose (fig. 5).

This spinner spins well even in moderate wind.

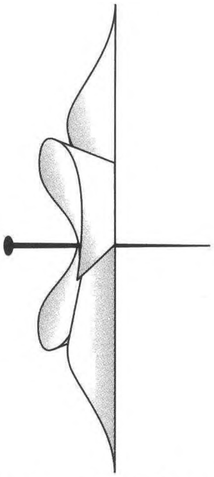


Figure 4 (Side-view)

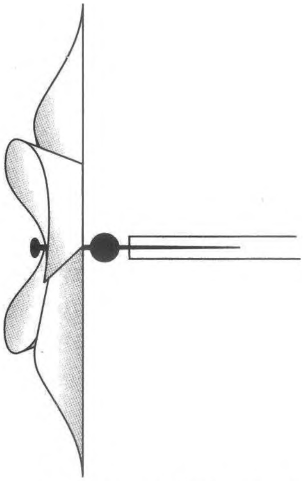
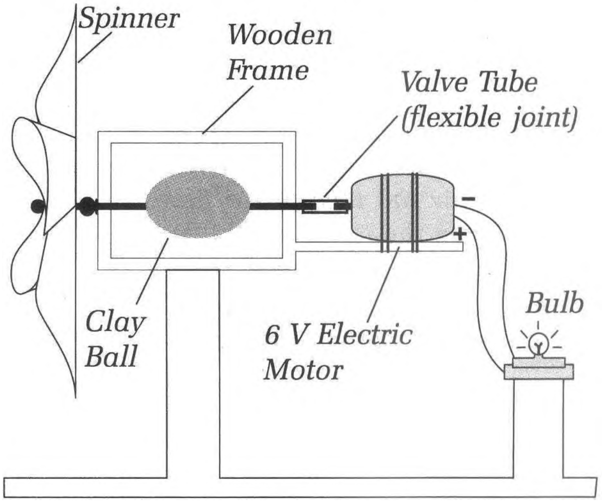


Figure 5 (Side-view)

A spinner with a diameter of about 30 cm. made from thicker paper, generates significant energy. If an electric motor is fitted onto the axle then it can easily produce electricity enough to light an L.E.D. If the wind is strong, this generator can even light a small bulb. You can make an impressive science project on 'wind energy' using such ordinary material. The sketch given here will enhance comprehension.



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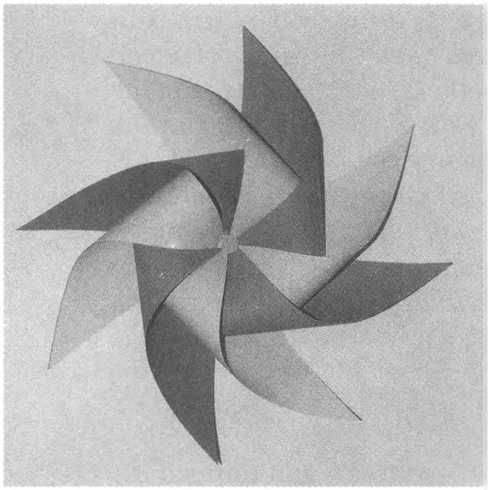
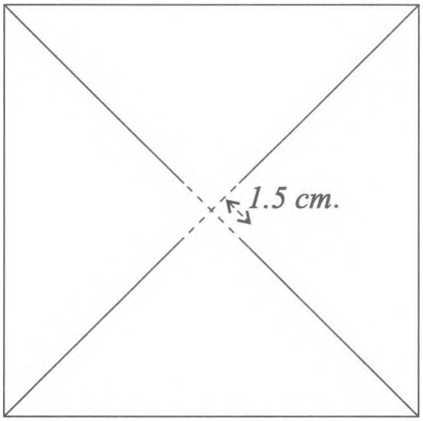
Spinner with eight blades



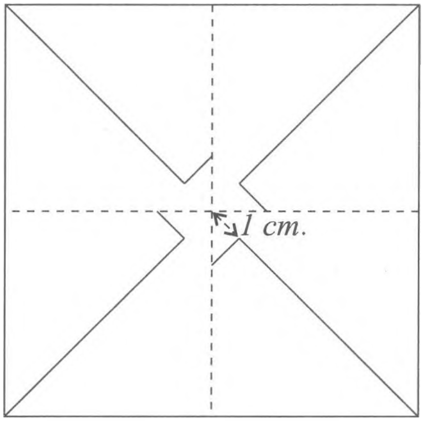
Like the spinner with four blades, you can make one with eight blades by combining two squares. It is highly necessary to ensure geometrical accuracy while joining these two squares. Thus you need to draw the diagram carefully before cutting. Begin with two squares of equal size.

Take two square piece of paper of size 15 cm. Draw the diagonals on one of the squares and cut along the diagonals stopping 1.5 cm. from the centre (fig. 1).



1st Square – Figure 1

On the other square, cut along the diagonals stopping 1 cm. from the centre. Draw the medians of the square. From the lower end of the cut, draw a perpendicular up to the median as shown in figure 2. Cut along this perpendicular.



2nd Square – Figure 2

Place this square over the other with their diagonals forming an angle of 45 with each other. Each portion of paper on which the additional cut have been made is to be shifted at the back and the corresponding portion of the lower square is to be brought up. It is extremely difficult to describe this procedure in words. You would understand it quickly as you actually start working.

When done properly, the squares will entangle into one another as shown in fig. 3.

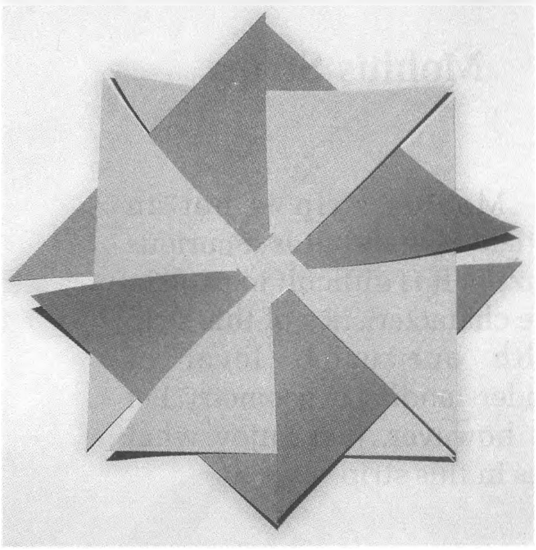


Figure 3

The later work is easy. First flip this structure over and you will notice the corners at the back. Stick the corners in place so that the combination does not get disturbed. Flip it over again and combine the eight corners as usual pushing a pin through them. Finally push the pin through the centre. Slide a bead and push the pin into a stick. You can make two squares of two different colours to make this spinner look more attractive (fig. 4).

I would now like to provide some food for you brains! Do you think it possible to make a spinner of 12 blades from 3 squares? or 16 blades from 4 squares? Do try and if you succeed, inform me with your details.

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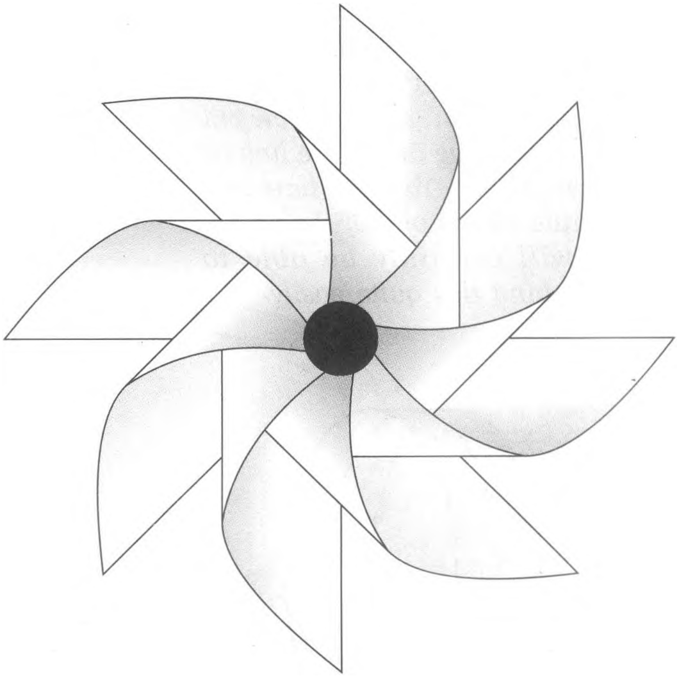
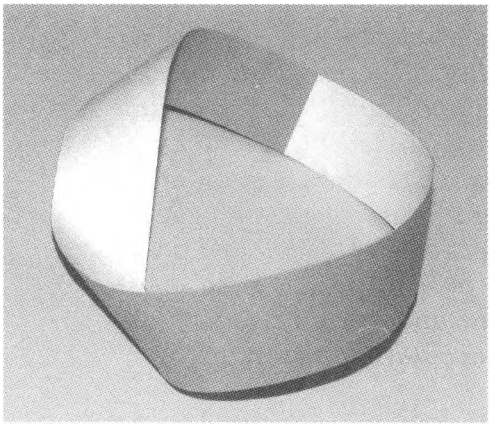
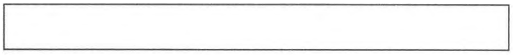


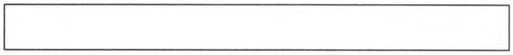
Figure 4

Mobius Strips

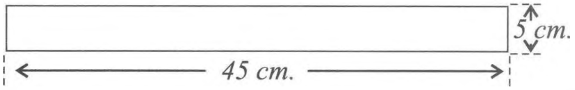
Mobius strip is not an article of craft but is a curious puzzle. It is difficult to explain the characteristics of this strip with our usual level of understanding of geometry. Let us however, just enjoy what lies in this strip.







Cut a few strips of about 45 cm. length and 5 cm. width. Roll one strip by pasting the two ends together to form a circle. Now cut this circle along the centre line as shown in fig. 1. You now have two separate circles of half the width. You will certainly be able to understand this quite easily.



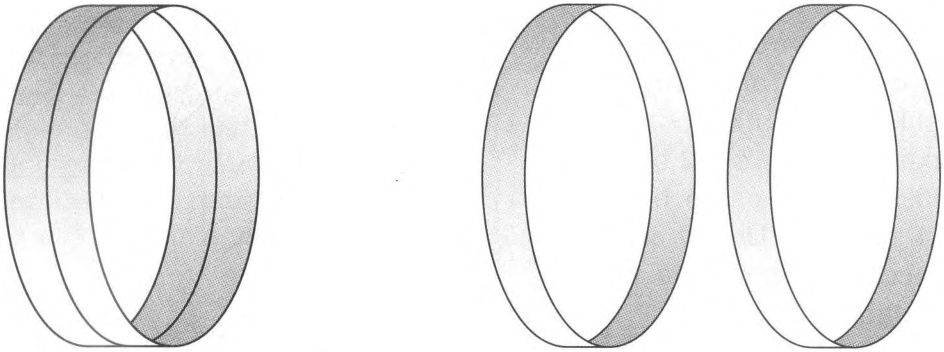
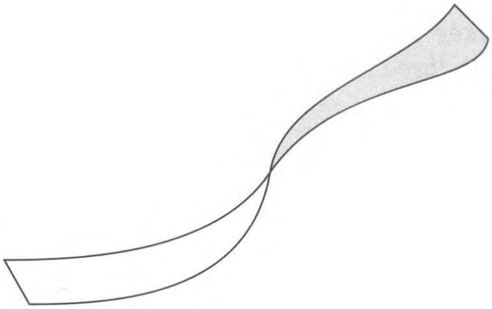


Figure 1

Now join the two ends of the other strip, with a little modification. Paste the other end by flipping over its sides as shown in the figure. This will produce one twist in the circle (fig. 2). Now cut this circle at the centre. Instead of getting two circles as expected, you would actually get only one circle of double the size and with two twists, as in figure 3. If you again cut this long circle in centre, you may expect that it would further get doubled. But what actually happens is again quite unexpected!



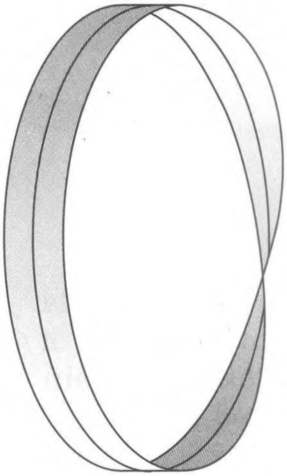


Figure 2

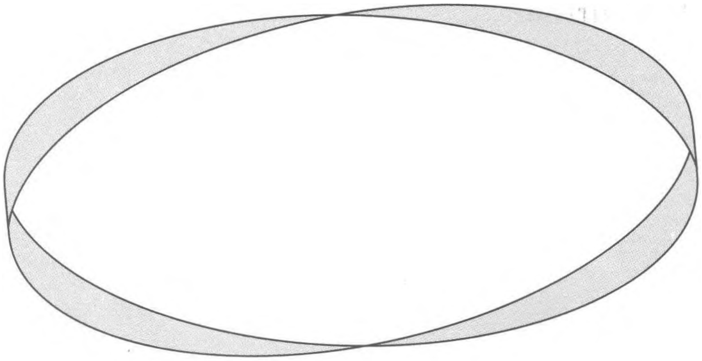
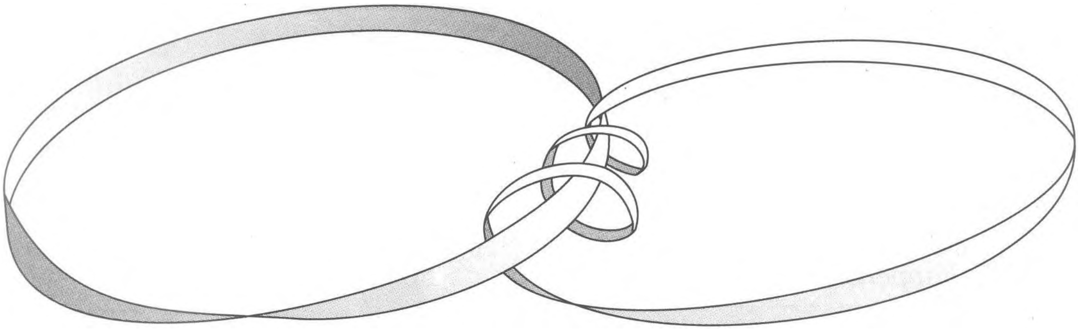


Figure 3

It makes two entangled circles, one with three twists and the other with only one!



Do this as a trick to puzzle the others, however it is a challenging task to explain geometry involved in it.

If you go on cutting these circles further, it is further more puzzling.

□ □ □

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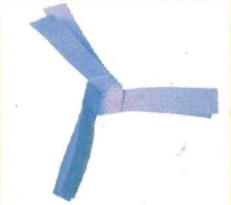

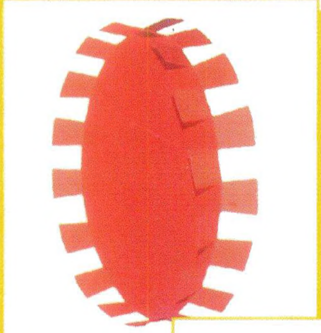

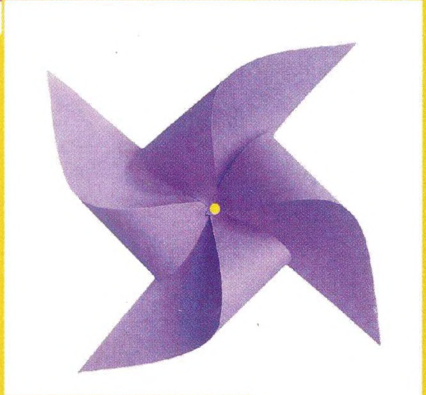

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